Forces Open Book Group Test

Names_____Block_____

1. What are Newton's 3 laws? Give an example of each.

Law of inertia – object stay at rest or at constant velocity unless an unbalanced force is applied. Eg. A cart rolls until it hits something if the wheels have little friction.
Law of acceleration – F=ma if I push on a small car, I can make it accelerate from rest but if I push a big truck, it is not going anywere.
Action reaction law – When I push on something it pushes back with an equal and opposite force. When I punch the wall, my hand hurts. When I push on the table, I accelerate back.

2. A 0.50 kg ball is thrown sideways with a force of 10.0 N. What is the

a) acceleration?

a=F/m = 10.0N/0.50kg = 20 m/s^2

B) speed when it leaves your hand if d=1.5 m?

$V^2 = vi^2 + 2ad$
$V = \sqrt{(2x20m/s^2 x1.5m)} = 7.7$ m/s

3. You are standing on a scale that reads in Newtons in an elevator. Your mass is 60.0 kg. What does the scale read when you are

a) at rest

F=mg = 60.0kg x 9.80N/kg = 588N

b) accelerating up at 2.0 m/s^2

F=ma = 60kgx2.0m/s^2 = 120N
Fup-Fdown = Fnet
Fup = Fnet+Fdown
Fup = 120N + 588N = 708 N

c) moving up at 2.0 m/s

same as at rest = 588N

c) slowing down at -1.0 m/s^2.
d) F=ma = 60kgx-1.0m/s^2 = -60N
e) Fup-Fdown = Fnet
f) Fup = Fnet+Fdown
g) Fup = -60N + 588N = 528 N = 530N

h) The elevator cable is cut and you freefall?

You fall with the elevator so Fup = 0 as a=g

4. A 5.0 kg block is pulled with 10.0 N. a) find μ is v is constant.

Ff = Fa if v is constant

μ= Fa/FN = 10N/(5kgx9.8N/kg) = 0.21

b) find a if μ is 0.10

Ff=μFN = 0.1 x 5 x 9.8 = 5.88N

a = Fnet/m = (10N-5.88N)/5kg = 0.82m/s^2

5. A 5.0 kg lead sphere is hanging from a spring on planet X with g = 7.0 N/kg. What is the

a) mass of the lead sphere on planet X?

mass is the same, 5.0 kg

b) weight of the lead sphere on planet X?

W=Fg = mg = 5kgx7N/kg= 35N

c) spring constant if it extends 5.0 cm

k=F/x = 35N/5.0cm = 7.0 N/cm or 0.070N/m

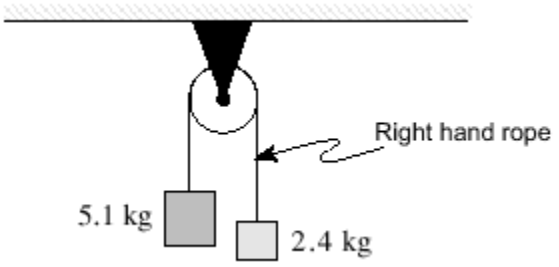
i) mass of the planet if r = 6.0 x 10^5m.

g = GM/r^2

M= gr^2/G = 7.0N/kg x $(6x10^5m)^2$/$6.67x10^{-11}Nm^2/kg^2$

M= $3.8x10^{22}$kg

6. A 5.1 kg mass and a 2.4 kg mass are connected by a string over a pulley. What is the tension in the right hand rope?



Fnet = ma = Fg1-Fg2

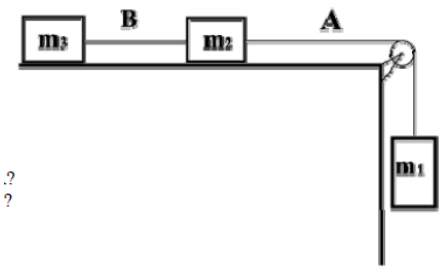
a= (m1-m2)xg/(m1+m2) = (5.1kg-2.4kg)x9.8N/kg/(5.1kg+2.4kg)

a= 3.528m/s^2

Ft-Fg = ma

Fg= ma+mg = 2.4kgx3.528m/s^2 + 2.4kg x 9.8N/kg = 32N

7. What is the tension in the string at B and at A if m1 is 8.0kg, m2 is 6.0 kg and m3 is 3.0 kg and the table is frictionless?



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Fnet=ma
a=m1g/(m1+m2+m3) = 8.0kgx9.8N/kg/(8.0kg+6.0kg+3.0kg)
a= 4.6118 m/s^2
Ft at B = 3kg x 4.6618 = 14N
Ft at A = (3+6)x4.6618 = 42N

Bonus Answer again if the coefficient of friction is 0.20 between the masses and the table.

Fnet=ma = m1g – μ (m2+m3)g = 8kgx9.8N/kg – 0.2x (6+3kg)x9.8N/kg = 60.76N
A=Fnet/(m1+m2+m3) =60.76N/(8.0kg+6.0kg+3.0kg)
a= 3.5741 m/s^2
Ft at B = 3kg x 3.5741m/s^2 + 0.2x3kgx9.8N/kg = 16.7N
Ft at A = (3+6)x3.5741+(0.2x9x9.8) = 49.9N